

Dinner Speech: Follow-up in the age of surveys

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1. Introduction

Many dinner speeches are not prepared but still given, so this is probably one of the few that was prepared but never given. The reason for this is the fact that the conference dinner was held on the roof of the Kyoto Holiday Inn, where the ‘beer garden’ provided a wonderful ambience, but where any attempt to words of wisdom would have been immediately lost on the wind. Committing them to paper is my effort to make them longer lasting.

First of all I would like to thank the organisers of this meeting, and in particular Daisaku-san for bringing together such a diverse and broad community on the topic of accretion physics. Accretion is one of those ‘universal’ processes that is still poorly understood, but at the same time encountered in a large variety of astronomical settings. From the compact binaries discussed here to young stellar objects, supernovae fall back disks and gamma ray bursts and the large, massive disks found in active galactic nuclei.

Looking around I see that it is a very active and young community. If not always young of age then at least of heart! This is a very good sign, since many challenges still lie before us, and over the next few years the possibilities in our field will grow as rapidly as the number of known objects. The field of accreting compact objects is reinventing itself. After a flurry of activity in the 1980s and 1990s there appeared to be a slump in activity in the early 2000s. A change is now occurring from an ‘object-based’ view to a ‘population-based’ view. No longer are our conferences dominated by talks on single, pet objects, but more and more the view is widened to address the question ‘What does the big picture look like?’. This is a very good and healthy progression. The field of Cataclysmic Variables (CVs) in particular was often stigmatized as splitting itself up into yet another subfield as soon as two new systems were found. Although questions related to the physics and structure of the myriad of subpopulations have not always been answered, more and more often a helicopter view is taken that tries to encompass the populations of compact binaries as a whole.

How do the different populations of compact binaries (CVs, symbiotics, novae, AM CVns, LMXBs, AMXPs) fit together? Can we understand underlying processes such as the physics of the common-envelope by comparing the sizes and characteristics of different populations with each other? For that matter: do the properties of a single population already give answers? What is the relation of compact binaries to other fields in astronomy? Examples that stand out in this respect are of course the progenitors of supernovae Type Ia, but also the populations of gravitational wave emitters and the possibility of new or surviving exoplanets around white dwarfs. Such a branching out is essential for the continued health of the field and the anchoring of compact binaries within the larger community of astrophysics.

During the conference we have already seen very nice examples of this population view. The almost Sisyphean-like effort of Paula Szkody and collaborators on uncovering the population of CVs in the Sloan Digital Sky Survey (SDSS) stands out in this respect. This is a prime example of how a population based view can answer long-standing questions. The orbital period distribution of the Sloan CVs as compiled by Boris Gänsicke and collaborators clearly shows the existence of the long-awaited and expected orbital period spike. It also shows the extreme care one has to take in taking observational selection effects properly into account: a point already shown quite nicely by the work of Reta Pretorius and Christian Knigge on the pre-SDSS population of CVs.

2. Big Surveys: the future is near

The SDSS is, however, only the beginning. The near future will see enormously large synoptic and static surveys that will allow us to significantly increase the known populations of compact binaries. Not only of CVs, but also of other, even more rare or relatively less-studied populations such as AM CVns, pre-CVs, sdBs, LMXBs, detached binary white dwarfs, AXMPs, novae, etc. Even more importantly, the systematic design and execution of most of these surveys allows us to construct observationally well-understood samples of compact binaries where it is possible to properly model the selection effects and correct for them. This is absolutely essential for a proper comparison of observational results with those from e.g. population synthesis modeling. Any of us designing and/or performing these large surveys should therefore aim to execute them as systematically and homogeneously as possible and to properly quantify the selection effects that went into the design.

Examples of these new and upcoming large surveys that will be very relevant for our field are the European Galactic Plane Surveys (EGAPS: IPHAS, UVEX and VPHAS+), Gaia, ATLAS (a Southern Sloan-like survey with the VST), the Galactic Bulge Survey and the large synoptic surveys: the Palomar Transient Survey, Pan-STARRS, SkyMapper, the VVV survey, and also of course Gaia and in the longer run the LSST. In the radio domain LOFAR will start operation in 2011, including the Transient Key Project, and proposals for variability surveys on the SKA-precursors ASKAP (Australia) and MeerKAT (South Africa) have been submitted. The work presented during this conference by Brian Warner and Patrick Warner on the Catalina Real Time Transient (CRTS) Survey and by Martin Still on the Kepler data shows just a glimpse of what is ahead in these synoptic surveys.

3. Necessary preparation

As a community we will have to be prepared for these surveys. Not only by designing efficient algorithms to mine these large databases for ‘our’ preferred populations, or by having the appropriate theoretical models to interpret the results, but most importantly to provide enough resources to execute the task of the photometric and spectroscopic follow-up on these systems. Many of the targets provided by the large surveys will require follow-up that is not a part of the surveys themselves. To characterize systems in terms of masses, orbital periods, mass-transfer rates, secular evolution and chemical composition will require vast photometric and spectroscopic follow-up. We need to be able not only to bring these resources to the field, but should also try to organize ourselves in such a way that we can do this follow-up in an efficient and homogeneous way.

Luckily we do, collectively, have the means to do this. We are a world community. I count participants to this conference from 22 different countries on 5

different continents. The only continent that is missing is Australia, but luckily we have Martin Still from outer space to make up for this. This large and widely-spread community offers us an enormous opportunity to tackle the challenge before us. The world will see only 2 or 3 Extremely Large Telescopes, but there are still many smaller telescopes in the 1-4m class that are perfectly suited for a large part of the required follow-up. In the western world the 2-4m class telescopes are under severe funding pressure, but I am delighted to see that in many other countries new telescopes in this category are coming into operation. Here we should tackle the challenge of systematic follow-up by trying to standardize our follow-up observations as much as possible. We should be like Japanese vending machines: available on every corner with a standard output, but they work like a charm! We should try to set-up a cheap, efficient network of ‘follow-up vending machines’ that deliver a homogeneous set of data that can easily be intercompared.

4. Multi-band photometry

My proposal is *not* to build a new network of telescopes. These we already have to a large extent. The proposal is to standardize our follow-up methods and instruments. It strikes me again and again how often we ‘waste’ astronomical information because our instruments are not designed to take full advantage of what modern technology can offer. Also during this conference we have seen beautiful photometric follow-up studies where on a particular object, for instance, 3000 frames have been taken, of which 2800 in, say, R , 200 in V and 2 in I . This is certainly not unique to our field. I see the same happening in the gamma-ray burst and supernovae follow-up, although the last is slightly better since the MCSL method for calibrating Supernovae Type Ia requires multi-band data.

Modern technology, however, should allow us to build a simple multi-band photometer that covers, e.g. the SDSS bands simultaneously and allows for a 1 second read-out of the CCDs. This is the type of instrument that we should have as a standard ‘photometer’ on as many of the 1-4m class telescopes in the world. Only when we these instruments will it be possible to come to a homogeneous approach to the photometric follow-up of the thousands of targets that will be provided by the next generation of large scale surveys.

5. Closing

In closing I would like to say again how much I am encouraged by the diversity of researchers present here. It has been a week of high spirits, and enthusiasm, and in this, I would like to say that we, as a community, should also take our Japanese hosts as an example. I have rarely been in a country where the cultural and language barriers appeared to be so large, but where the crossing of these barriers is undertaken with such an enthusiasm and such friendliness.

Domo arigato and itadakimasu